



NOsparc™

MHXAC1F120

MHXAC1F240

MHXAC1F480

PATENTS PENDING



“Arc Suppressor”

**Arc Suppression for
AC Power Relays, Contactors, and Snap-Action Switches**

User Manual



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IMPORTANT NOTES

This document provides information required to install a NOsparc™ arc suppressor. You must read and understand this document before installing this device.

If you have any problems with your installation, please refer to Technical Support contact information on the last page of this manual.

TRADEMARKS:

- “NOsparc” and the “flame” logo are trademarks of Arc Suppression Technologies LLC.
- “UL” is a trademark of Underwriters Laboratories, Inc.

All trademarks are property of their respective owners.

APPLICABLE DOCUMENTS:

Underwriters Laboratories
UL 508 Industrial Control Equipment
NKCR2 “Auxiliary Devices - Component”



The above mark indicates that Underwriters Laboratories, inc., has certified the NOsparc™ MHXAC as a UL Recognized Component for both Canada and the United States.

LIFE SUPPORT:

Arc Suppression Technologies products are specifically NOT authorized for use as critical components in life support devices or systems without the express written approval of the Chief Executive Officer of Arc Suppression Technologies.

As used herein:

- Life support devices or systems are devices or systems which support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.
- A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

LEGAL NOTICE:

Information in this document is believed to be accurate and is provided solely in connection with Arc Suppression Technologies products.

Arc Suppression Technologies makes no warranties, expressed or implied, regarding the information contained herein.

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Arc Suppression Technologies only accepts products for repair or return that are accompanied by a Return Material Authorization number from the appropriate distributor or sales representative.

Please refer to your original purchase agreement or contact your distributor or sales representative for return policy information.

SAFETY INFORMATION OVERVIEW

We use note, caution and warning symbols throughout this book to draw your attention to important operational and safety information.

“WARNING” describes an alert with information that is important for protecting personnel and equipment from damage.



“CAUTION” describes any condition that could result in damage to the equipment or result in physical harm to personnel.



The “SAFETY” alert symbol (an exclamation mark in a triangle) precedes a general CAUTION or WARNING statement. It describes safety requirements to meet local, national and international standards.

The electrical hazard symbol, (a lightning bolt in a triangle) precedes an electric shock hazard. It describes a potential electrical shock hazard which

can result in personal injury or death.

"NOTE" describes any item of interest to the user, owner or operator.

WARNINGS:

Follow extreme caution when applying NOsparc™ MHXAC to trip and close contacts or in circuits containing elements that can be energized by a 1/2 power cycle pulse. This User Manual must be thoroughly understood and accurately followed to avoid unintended equipment operation.



The assembly must conform to National Electric Code (NEC) safety standards, as well as locally applicable codes. Failure to do so could result in personal injury or loss of life. See the product rating curve for wire gauge selection, ambient temperature and current restrictions.



Follow extreme caution when conducting short cycle time tests, especially below the maximum rated cycle time for the associated relay; typically 3s. Even at significantly reduced power levels through the contacts, the relay contacts can become extremely hot due to contact arcing and pose a fire danger. ALWAYS FOLLOW THE RELAY MANUFACTURERS SPECIFICATIONS AND REQUIREMENTS. Standard relays typically have a maximum short period cycle time of 1200 cycles per hour.



Only authorized and qualified personnel should install and service the NOsparc™ MHXAC. Failure to comply with these recommendations may result in damage to equipment and property and injury to personnel.



Always test the function and performance of NOsparc™ MHXAC in the intended application.

An arc suppressor DOES NOT eliminate arcing, therefore, use of the NOsparc™ MHXAC will not eliminate hazards associated with electrical current contact arcing.



SAFETY:

All creepage distances and clearances of NOsparc™ MHXAC have been designed to meet requirements of safety standards.

When using NOsparc™ MHXAC, basic safety precautions should always be followed to reduce risk of fire, electric shock, and injury to persons. When installing NOsparc™ MHXAC into your system, make sure that the Quick Connect Terminal connector is properly crimped, terminated, insulated and that the proper wire gauge is used and that the connector is securely seated. Incorrect application or termination can result in harmful or fatal electrical shock or component damage.



CAUTIONS:

The NOsparc™ MHXAC will pass a leakage current (see specifications) even though the contacts across which it is connected are open (similar to leakage present with snubber use). This capacitive leakage current can be sufficient to turn-on some solid state and electromechanical relays, or to cause electric shock to personnel. Therefore:

- The NOsparc™ MHXAC must never be connected across relay, contactor, or snap action switch contacts driving high impedance loads.
- The NOsparc™ MHXAC must never be connected across relay, contactor, or snap action switch contacts used for galvanic/ safety isolation.

Proper care must be taken when handling and installing NOsparc™ MHXAC.

Never plug or unplug NOsparc™ MHXAC while powered.

Do not connect NOsparc™ MHXAC directly to power!

Use caution when installing or modifying power connections.

NOTES:

Connect NOsparc™ MHXAC across the power switching relay, contactor, or snap action switch contacts only!

NOsparc™ MHXAC capabilities will be fully effective even under mixed load conditions.

NOsparc™ MHXAC has been designed to support the following AC power loads:

- | | | |
|-------------------|-------------|--------------|
| • General Purpose | • Inductive | • Ballast |
| • Resistive | • Motor | • Pilot Duty |
| • Capacitive | • Tungsten | |

DO NOT use NOsparc™ MHXAC for DC power applications.

DO NOT use NOsparc™ MHXAC under the following power conditions:

- Non-sinusoidal power circuits
- Phase controlled power circuits

DO NOT connect NOsparc™ MHXAC across the following components:

- | | |
|--------------------|---------------------|
| • Fuses | • Safety interlocks |
| • Circuit breakers | • Thermal limits |

DO NOT use NOsparc™ MHXAC either above or below its ratings or specifications.

DO NOT operate the contacts to which the NOsparc™ MHXAC is attached above or below their ratings or specifications.

PRODUCT DESCRIPTION

NOsparc™ MHXAC products (AC power applications) are a family of two-terminal contact arc suppressors that attach across the contact points of a power relay, contactor or snap action switch. The products are designed to protect the contact points from premature destruction due to contact current arcing.

BACKGROUND:

Electromechanical power relays, contactors, or snap action switches operating without load current may have potential mechanical lifetimes of 10M, 20M or even more operations (cycles). This mechanical lifespan, however, is reduced to as few as 5,000 operations to perhaps 100,000 operations (depending on application and specifications) when the under power.

This is mainly caused by the deleterious effects of load current arcing across the contacts as they break or bounce.

Arc Suppression Timing Diagram



The arcing across the contacts is literally a small lightning bolt, as shown below:

Left: Relay contacts at rest.

Right: Electrical contact current arc across the contact points of the same relay.



Pictures ©2011 Arc Suppression Technologies, all rights reserved.

ARC SUPPRESSION AND CONTACT PROTECTION:

NOsparc™ MHXAC detects the nascent arc as it forms and suppresses its energy all within about 5µs (5 millionths of a second!). The result is a low energy "arclet" with arc energy of only a few µJ as opposed to a full contact arc that is hundreds of mJ (or more). This allows an arc suppression factor to be calculated from the difference in energy. (More information is available in lab notes and application notes on our website.)

ADD "HOW DOES IT WORK"

Please note that this residual "arclet" is important as it both burns through the protective thin film coating during initial operation, and subsequently cleans of the contact surfaces during normal relay operation.

The effects of the destructive power of arcing is depicted in the pictures below:

CHARACTERISTICS:

NOsparc™ MHXAC extends contact life without requiring any external control wires, power wires or any other wires other than the two contact terminal wires that are used to connect the device to the associated power relay, contactor, or snap action switch.

NOsparc™ MHXAC requires only two wires to monitor the contact status in order to suppress the contact current arc in the instant when the contact transitions from close to open state.

RELAY END-OF-LIFE (EOL):

Every relay has a finite operating lifetime. For example: If a power relay with a 100,000 cycle electrical life is operated once every minute (60s), it will reach its EOL in a mere 69 days!

NOsparc™ MHXAC extends the inevitable end-of-life of contacts by a factor of 100 times or more under normal, specified operating conditions (please refer to the relay, contactor, or snap-action switch specifications).

The natural end-of-life (EOL) is failure in one of the following three modes:

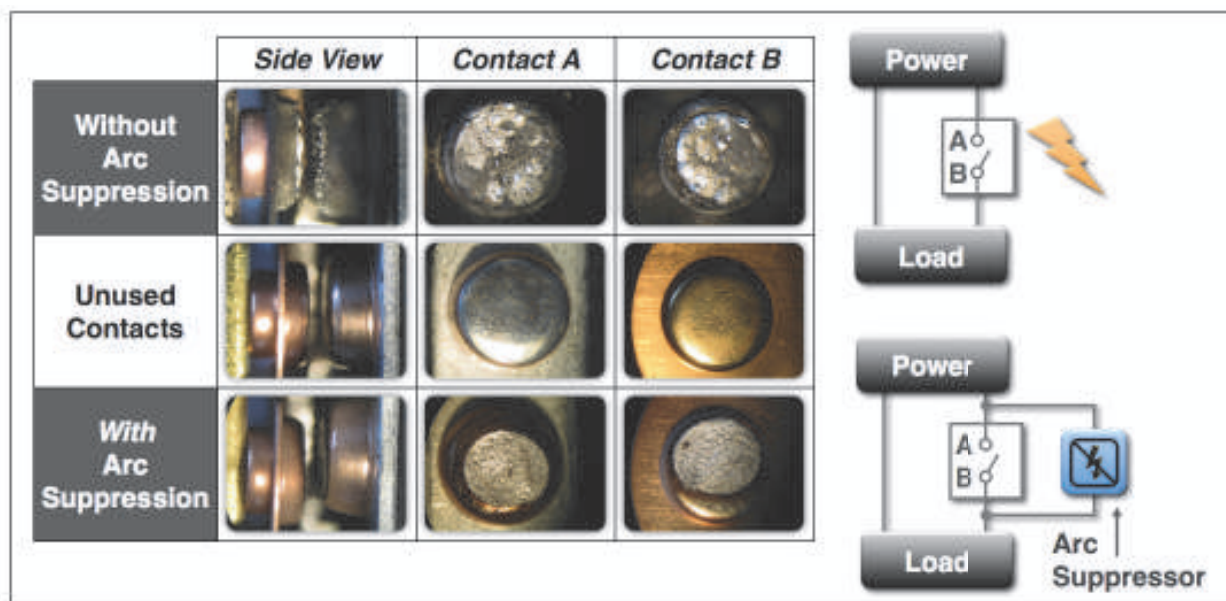
1. Contact fails closed
2. Contact fails open
3. Contact fails with resistance

This inevitable EOL can be extended out even further with the proper use of a NOsparc™ MHXAC.

SYSTEM WIRING

NOsparc™ MHXAC has two male quick connect terminal which must mate with two properly crimped female quick connect terminals.

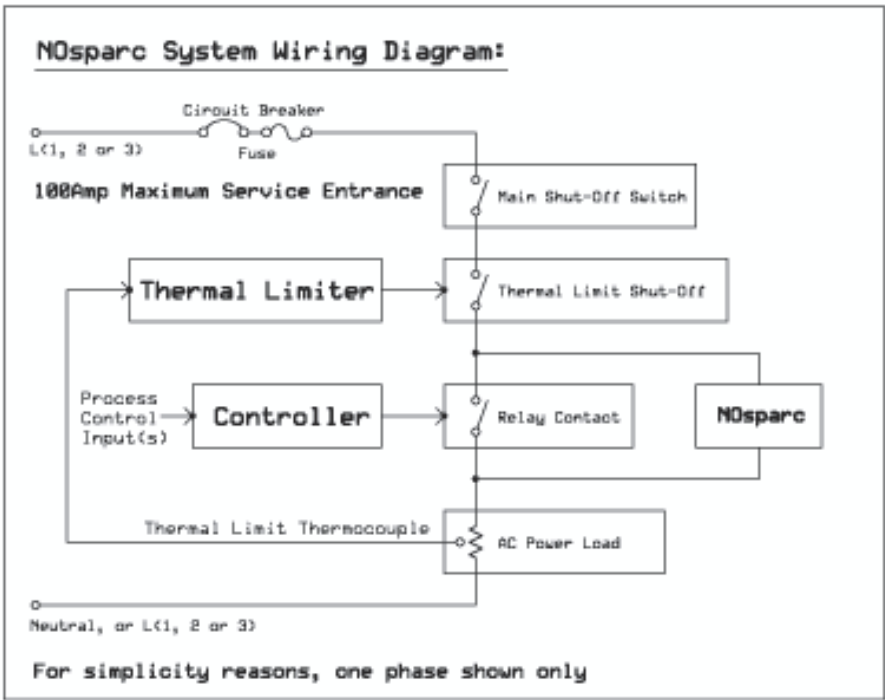
In order to provide effective arc suppression, the two wires between NOsparc™ MHXAC and the relay, contactor, or snap action switch contact terminals should be as short as possible.



One foot or less of wire length is ideal; lengths over 3 feet are not recommended. If longer cable lengths are needed, then the wire gauge must be increased according to the following recommendation:

- #16AWG (minimum) for less than 0" to 12" of wire length between NOsparc™ MHXAC terminals and the contact terminals

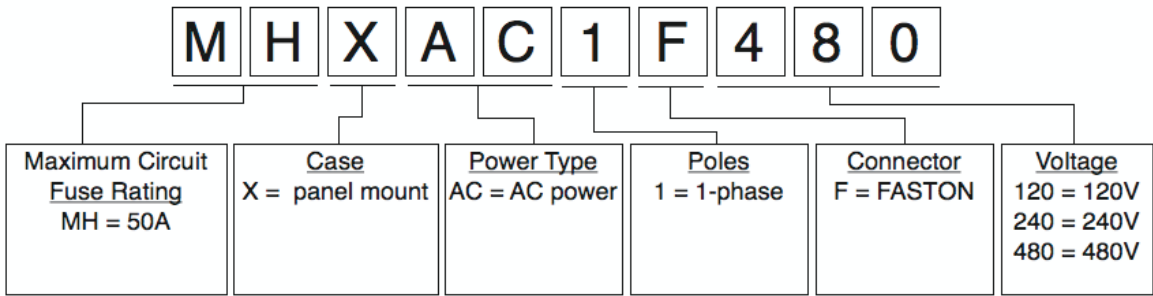
- #14AWG (minimum) for less than 12" to 24" of wire length between NOsparc™ MHXAC terminals and the contact terminals
- #12AWG (minimum) for less than 24" to 36" of wire length between NOsparc™ MHXAC terminals and the contact terminals



NOsparc™ AC POWER PRODUCT FAMILY

Part Number and Product Description

Part Number: **NOsparc™ MHXac 1F 480**

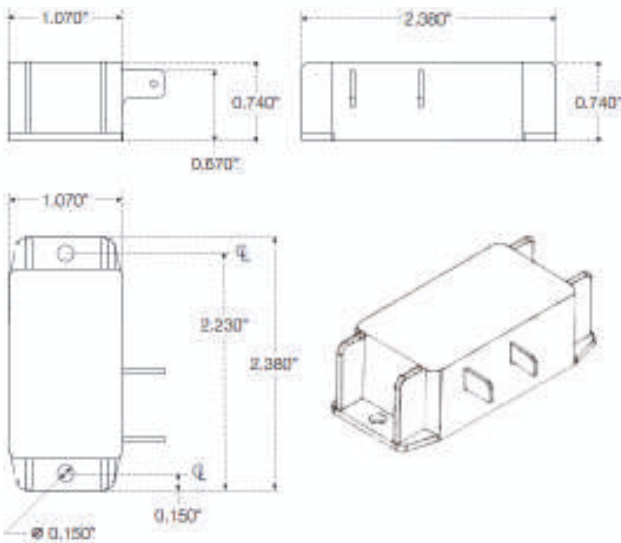


SPECIFICATIONS

| NOsparc™ MODEL | MHXAC1F120 | MHXAC1F240 | MHXAC1F480 |
|---------------------|--|-----------------------|-----------------------|
| ARC CURRENTS | break: "steady-state" make: "inrush" | | |
| ARC SUPPRESSION | duration: ½ AC power cycle (maximum) | | |
| CIRCUITS (POLES) | one (1) unit per pole (multiple units required for multi-pole relays) | | |
| CIRCUIT FUSE RATING | maximum: 50A (do not exceed fuse rating) | | |
| CLAMPING VOLTAGE | 205V (typical at 1mA) | 410V (typical at 1mA) | 820V (typical at 1mA) |
| CONTACT CYCLING | maximum cycle time: per relay specifications (<u>DO NOT EXCEED</u> relay operating specifications) | | |
| DIMENSIONS | length: 2.380in (6.045cm) width: 1.070in (2.718cm) height: 0.740in (1.880cm) | | |
| ENVIRONMENTAL | operating temperature: -40°C to 85°C (-40°F to 185°F) storage temperature: -50°C to 125°C (-58°F to 257°F) humidity: 5% to 95% (non-condensing) | | |
| FREQUENCIES | typical operating frequencies: 50Hz / 60Hz | | |
| INTERFACE WIRES | across contacts: two (2) (W1/W2 non-polarized) | | |
| LEAKAGE CURRENT | 4mA (nominal) | 6mA (nominal) | 10mA (nominal) |
| MOUNTING | orientation: any number of holes: two (2) hole diameter: 0.150in (#6 screw) (3.81mm) | | |
| OPERATING VOLTAGE | 120Vac (nominal) | 240Vac (nominal) | 480Vac (nominal) |
| POWER-ON | load current passthrough: ½ cycle (maximum) | | |
| POWER TYPE | AC (alternating current) | | |
| RELIABILITY | MTBF: 50,000 years (MIL-HDBK-217F) | | |
| TERMINATION | 0.250in quick connect male terminals (non-insulated) | | |
| TERMINATION MATE | 0.250in quick connect female terminals (fully insulated) | | |
| WEIGHT | net weight: 1oz (28g) | | |
| WIRE GAUGE | wire length 0in to 12in: #16AWG (wire length between Nosparc™ and contact terminals) wire length 12in to 24in: #14AWG (wire length between Nosparc™ and contact terminals) wire length 24in to 36in: #12AWG (wire length between Nosparc™ and contact terminals) (NOTE: Wire lengths over 3 feet are NOT recommended) | | |

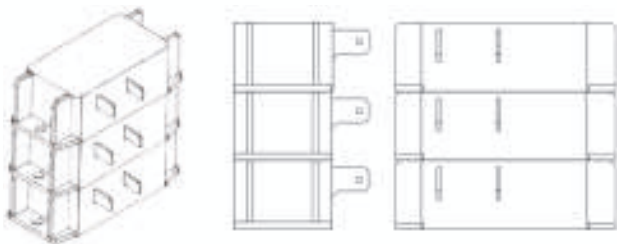
CASE SPECIFICATIONS AND MOUNTING

CASE DIMENSIONS:



PANEL MOUNTING:

For ease of installation, NOsparc™ MHXAC units may be stacked up to three (3) units high by threading a #6 screw through the mounting holes in the flanges of each unit as shown below:



DIN RAIL MOUNTING:

DIN rail mounting of either single or stacked arc suppressors can be accomplished by adding a single DIN rail mounting adaptor (accepting a #6 screw) to each side of the single arc suppressor or stacked arc suppressors.

DEFINITIONS

| | |
|-----------------------------------|--|
| Arc Current | Plasma flow supported between open contacts |
| Arc Suppression Duration | Time during which the electrical current contact arc is arrested |
| Arc Suppressor | Device designed to reduce contact arcing |
| Break | Action of a contact which transitions from close to open |
| Bounce | One or more brief transition(s) to the OPEN state as the contact is closing <u>or</u> to the CLOSE state as the contact is opening |
| Break Current | Contact current during Break |
| Cycle Time | Time between successive ON or OFF contact states |
| Inductive Load | Motor or transformer form the main part of the load |
| Inrush Current | Resulting turn-on current when powering an inductive, capacitive or tungsten load |
| Inrush Current Limiter | Device intended to limit the amount of turn-on current when powering an inductive, capacitive or tungsten load |
| Make | Action of a contact which transitions from open to close |
| Make Current | Contact current during Make |
| MOV | Metal Oxide Varistor |
| MTBF | Mean-Time-Between-Failures |
| Power-On Passthrough | Current passing through the arc suppressor during initial power-up |
| RC Snubber | Device with resistor and capacitor in series across contact |
| Snubber | Device designed to limit voltage rise times |
| Suppression | Action of minimization of undesired event |
| Varistor Clamping Voltage | Voltage at which steady state current through the arc suppressor is $\geq 1\text{mA}$ |
| Maximum Varistor AC Voltage | Maximum allowed voltage across the arc suppressor (NOT operating voltage) |

WARRANTY

Please contact your distributor or sales representative for warranty information.

TECHNICAL SUPPORT

Please contact your distributor or sales representative with technical support and product support questions.

Have the following information available when contacting your representative:

- Model Number
- Serial Number

In certain circumstances, direct product support from Arc Suppression Technologies may be reached via the following communication methods:

- support@ArcSuppressionTechnologies.com
- <http://arcsuppressiontechnologies.com/Support.aspx>
- (612) 928-5546

CONDITIONS FOR SERVICE

In the event of a product malfunction, Arc Suppression Technologies or an authorized agent should perform all repairs to a NOsparc™ MHXAC unit. It is the responsibility of users requiring service to report the need for service to their distributor or sales representative.

Any components, devices or other equipment used with or adjacent to a NOsparc™ MHXAC device is the sole responsibility of the end user and not of Arc Suppression Technologies or any of its agents, resellers, representatives or distributors.

RETURN MATERIAL AUTHORIZATION AND PROCESS

Authorization prior to returning product is required. Please refer to your original purchase agreement or contact your distributor or sales representative for an RMA number and instructions before returning product.

NOTE: Terms and conditions vary by distributor and representative. Please refer questions to your distributor or sales representative.

CONTACT INFORMATION

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BLOOMINGTON, MN 55425

612-928-5546

www.ArcSuppressionTechnologies.com

Your Comments:

We welcome your comments or suggestions on this User's Manual.